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ABSTRACT

This paper describes a five-phase, 20-week, computer supported reading comprehension instruction process, which begins with access to powerful supports and direct teacher-mediated instruction. The process involves five phases: (1) fully supported reading and strategy instruction; (2) strategy practice in a fully supported reading environment with teacher review of generated comprehension strategy questions; (3) independent strategy practice in a partially supported environment with teacher review of generated comprehension strategy questions; (4) strategy practice in a partially supported environment with peer review of generated comprehension strategy questions; and (5) generalization to a paper-based text in a partially supported environment with teacher and group review of generated comprehension strategy questions. Several elements are common to all phases: all instruction occurs within the context of a resource room or separate classroom for students with learning disabilities; each phase is approximately 4 weeks duration, with at least 10 hours of instructional time; during each phase, new text is used; and students working in pairs take turns using the speech-to-text capability to dictate their responses during alternating instructional sessions. Project development, implementation, and evaluation are described. (SM)

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Deeper than Blueberries:

A Reciprocal Teaching Method Approach to Narrative Text in an Electronically Supported Learning Environment

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PROJECT ABSTRACT

Engaging the Text: Reciprocal Teaching and Questioning Strategies in a Scaffolded Learning Environment

1. In the area of reading comprehension, students with learning disabilities and their teachers have at least one thing in common – while they both learned effective strategies, they may be unable to bring them into play. For students, the process of decoding words requires so much effort that they are often unable to approach text strategically to construct its meaning, in spite of having been taught helpful strategies. Likewise, many teachers know about labor intensive teaching strategies which have been shown to be successful in helping students, but they simply do not have the time or resources to implement them consistently.
2. A common solution in the face of such limitations is to multiply limited capacity by with better tools. In the proposed project we seek to investigate whether there are better classroom tools available to support students with learning disabilities in becoming strategic readers.
3. Our research plan is a mirror of what we intend for our teachers and students. We will use existing strategies for teaching students with learning disabilities, but we will apply those strategies in the context of a more supportive technology than those usually found in classrooms. We propose to combine promising strategies with supportive technologies and then to asses whether this combination creates a better environment for both the teaching and learning.
4. The teaching strategies we will use are adopted from the Reciprocal Teaching Method which has been developed and researched over the last two decades. We will integrate these methods for developing active reading strategies within traditional curricular content that has been significantly enhanced through text-to-speech and speech-to-text technologies. In this digital form there will be many supports for the apprentice reader – in both decoding and strategy development. These new highly supportive curricular materials will provide scaffolding for students during instruction

and practice. As the student develops competency in active reading, electronic and pedagogical supports will be gradually withdrawn.

5. CAST will assess the success of this method in helping learning disabled middle school students develop comprehension skills and achieve success that is evident across reading contexts through a systematic, controlled evaluation of the method. Results will be disseminated through avenues that will affect both the kinds of curricula that are being developed – at a time when publishers are seeking digital solutions to demands for inclusion – and the strategies for using the new kinds of curricular technologies that are arriving in every classroom in America.

The Intervention:

We have devised a five phase, twenty week process of computer supported reading comprehension instruction, beginning with access to powerful supports and direct teacher-mediated instruction. The process proceeds through three support fading and practice phases to a final phase of generalization in an ordinary, unsupported, text-on-paper environment.

Several elements are common to all phases of our proposed instructional technique: a) All instruction will take place within the context of a resource room or a substantially separate classroom for students with learning disabilities. b) Each phase is of approximately four weeks duration, encompassing a minimum of ten hours of instructional time. c) During each phase, new text will be used. d) Students working in pairs will take turns using the speech-to-text capability to dictate their responses during alternating instructional sessions.

Phase One: Fully supported reading and strategy instruction:.

Students, in groups of up to four, will work directly with a teacher and the computer. Teachers will instruct the students in Reciprocal Teaching, including the importance of monitoring their own understanding of text as they read, and in the generation of appropriate questions with which to do this. Students will also be taught to use CAST's eReader™ text to speech software and Naturally Speaking™ or other appropriate dictation (speech-to-text) program both separately and in combination.

The eReader will read digitized versions of their own Language Arts books (primarily novels), prepared with embedded questions of the sorts that students are learning to generate as they read, into audible spoken words. This use of copyrighted material is permitted under the doctrine of fair use. This will: a) support students' decoding skills, allowing them to concentrate on comprehension, b) expose them to appropriate strategies in the context of reading materials, and c) familiarize them with comprehension monitoring questions in context, modeling the generation process that they will undertake independently in subsequent phases.

Phase Two: Strategy practice in a fully supported reading environment with teacher review of generated comprehension strategy questions:

In groups of two, students will use the text-to-speech capacity of CAST's eReader™ to "read" chapter length passages from their own Language Arts books. At intervals in the prepared texts, the computer's voice will prompt students to generate, ask themselves, and answer comprehension questions of the sort they were taught to generate and use during the first phase. One of the pair will "write" the questions into the passage at the prompts using the Naturally Speaking™ speech-to-text system.

When the passage has been read and the questions generated, students will save their work electronically and print a copy out for review by their teachers and the experimenters. Teachers will give students feedback on the appropriateness of the generated questions, and provide further instruction as needed.

Phase Three: Independent strategy practice in a partially supported environment with teacher review of generated comprehension strategy questions:

In groups of two, students will use the text-to-speech capacity of CAST's eReader™ to "read" chapter length passages (but <u>not</u> prompts to ask themselves questions) from their own Language Arts books. At intervals in the prepared texts embedded icons that "speak" directions when clicked with the mouse will prompt students to generate, ask themselves, and answer comprehension questions. One of the students will "write" the questions into the passage using the Naturally Speaking™ speech-to-text system.

When the passage has been read and the questions generated, students will save their work electronically and print a copy out for review by their teachers and the experimenters. Teachers will provide feedback on the appropriateness of the generated questions.

Phase Four: Strategy practice in a partially supported environment with peer review of generated comprehension strategy questions:

In groups of two, students will read chapter length passages to themselves. These passages will be presented on the computer's screen, but the <u>text-to-speech capacity will not be available</u>. Students will generate, ask themselves, and answer comprehension strategy questions as they have before, but they will not be prompted <u>when</u> to generate

them. with one student "writing" the questions into the passage using the Naturally Speaking™ or other speech recognition software. When the passage has been read and the questions generated. students will save their work electronically and a copy of the computer file will be given to the teacher. This file will later be provided to a pair of students who are to read the same passage. The second pair will use the student-prepared comprehension strategy questions and. in a brief meeting with the teacher and the students who generated the questions. share their impressions of the usefulness of the questions and make suggestions for improvement where warranted.

Phase Five: Generalization to paper based text in a partially supported environment with teacher and group review of generated comprehension strategy questions:

In groups of two, students will again read. Their passages will be presented in standard written form, but photocopied copies will be used so that students can mark on the text. At intervals in the prepared texts, students will generate, ask themselves, and answer comprehension strategy questions. One will "write" the questions into a computer file using the Naturally Speaking™ speech-to-text system.[1] When the passage has been read and the questions generated, students will save their questions electronically and print a copy out for review by their teachers and the experimenters.

Research Design

Year 1: Development of the instructional technique through formative evaluation: (1998-1999) During the first year of the study, the focus will be on developing the instructional technique. To this end, a formative evaluation consisting of four overlapping development cycles will be conducted, and the methods used to collect information during this phase will be primarily those of qualitative inquiry (Lawson, 1974; Flagg, 1990).

Research Question: What elements should be built into an instructional technique that integrates Reciprocal Teaching plus technology-based supports for practice to help students with learning disabilities take an active role in their own reading comprehension by engaging in self-questioning and other validated comprehension strategies?

This phase consists of four overlapping cycles (see table 1) In the first cycle, we will develop and test teacher procedures for reading comprehension and questioning strategies instruction, and test usability of existing elements of the technology (CAST's eReader™ and Naturally Speaking™). In cycle two, we will focus on different ways of incorporating the four elements of reciprocal teaching: a) questioning, b) summarization, c) prediction and d) seeking clarification on unclear points, into formatted text to be "read" by the computer. In cycle three, we will examine the frequency and placement of prompts in text. In cycle 4, we will combine what we have learned in the previous cycles and apply it to a paired practice situation.

Table 1: Timeline[1]

PHASE 1		**(Year 1)**		
Systematic formative evaluation to develop the new instructional technique				
	Exploration	**Development**	**Trial**	**Refinement**
Cycle 1:	2 week exploration	2 week development	1 month trial	2 week refinement *(Cycle 2 begins)*
Cycle 2:	2 week exploration	2 week development	1 month trial	2 week refinement *(Cycle 3 begins)*
Cycle 3:	2 week exploration	2 week development	1 month trial	2 week refinement *(Cycle 4 begins)*
Cycle 4:	2 week exploration	2 week development	1 month trial	2 week refinement
PHASE 2		**(Year 2)**		
Twenty week pilot study of the instructional technique				
	Pretesting	**Trial**	**Post-testing**	**Final adjustment**
PHASE 3		**(Year 3)**		
Twenty week field testing and validation of the instructional technique				
	Pretesting	**Intervention**	**Post-testing**	
CASE STUDY	**(Encompasses Phases 2 & 3, Year 2 - Year 3)**			

[1] Please note that while conducting the evaluation, changes in the timeline may occur because of school vacations.

Within each cycle, there are four activities (see Table 1): a) Exploration is two-weeks of intense work with one group of five students, exploring target elements in the instructional technique. b) Development is one-month of materials and procedure development based on data gathered during Exploration. c) Trial is a one-month assessment of a more refined implementation of the instructional technique, and d) a one-month Refinement period based on data gathered during the Trial cycle.

Year 2: Pilot testing of the instructional technique: (1999-2000) During the second year of the study, the focus will be on testing the instructional technique during a twenty week pilot study; qualitative and quantitative techniques will be used. While not a formal evaluation, it will be in most respects summative. Intensive case studies of four students using the instructional technique will be initiated, and will continue through the third year. These will help us gauge the degree of generalization of active, strategic reading and resulting improvement to comprehension of classroom work.

Research Question: Does the newly developed instructional technique show promise to help students learn to read more strategically and so improve their reading comprehension?

During this phase, approximately 36 students will participate. At least 18 students will use the instructional technique and an equal number will serve as a control group, using standard written materials and ordinary instruction. Pre-tests measuring standardized reading comprehension and attributions/self-concepts will be administered to all students. Students in the intervention group will begin the 5 phase, twenty-week process of instruction plus computer supported reading comprehension strategy practice. Students in the control group will use standard text-based materials and receive teachers' customary instruction. Students will be observed using the approach twice weekly. Student and teacher feedback will be used to make final adjustments to the instructional technique. At the end of the twenty week process, students and teachers will be interviewed.

For both groups, work samples will be collected regularly and both experimenter designed assessments of reading comprehension and post-tests (the same measures used in pre-testing) will be administered.

Case Studies Investigate generalization of the instructional technique, case studies of four students chosen at random from one of the classrooms using the Year 2 intervention will be conducted during the second and third years of the project. These students will meet our stringent year-three criteria for identification as having a learning disability. During the second year of the study, the students will use the instructional technique, and will be monitored to gather information about their work and progress. Case study activities will include: Bimonthly observations of the students using the instructional technique, bimonthly observations of the students during reading periods, copies of student work in reading comprehension, pre and post test data in reading comprehension, questioning strategies and attributions/self-concepts around academics, interviews with students and teachers and collection of background information (e.g. IEP, etc.). In the third year of the study (the second year of the case study), these students will not be included in any of the three experimental groups, nor receive any instruction through this project. However, the standardized reading comprehension measures, observations and other data collection procedures will continue. Final case studies will be comprised of two years of data on four individuals.

Year 3: Evaluation of the instructional technique: (2000-2001) During the third year of the proposed study, the focus will be on measuring the effectiveness of the technology-enhanced intervention through a formal summative evaluation, employing a control group and random selection and assignment of students to control or intervention groups. Several schools will participate in this phase of study, yielding a sample of at least 80 middle school students with learning disabilities. Qualitative and quantitative techniques, including standardized measures of reading comprehension, will be used to collect efficacy information.

Research Question: Do learning disabled middle school students develop active strategic reading skills and reading comprehension ability in expository texts more

rapidly when taught using: a) the Reciprocal Teaching method and standard texts, or b) the newly developed technology-supported technique and electronic texts?

Procedures: The sample (n=80) will be divided at random into two groups: "traditional" Reciprocal Teaching, and the technology-enhanced Reciprocal Teaching group. The "traditional" Reciprocal Teaching group will use standard written materials and will receive instruction using Reciprocal Teaching. The second group use the final form of our new instructional technique, including digitized text and technology supports. Every effort will be made to hold direct instruction and practice time constant across the three groups: 2 1/2 hours per week for 20 weeks.

Pre-tests, post-tests, and interviews will be administered and student work collected.

(2) Sample

Students identified as having learning disabilities according to the Individuals with Disabilities Act Amendments of 1997, PL 105-17, criteria and determined to be at least two years behind age expectancy in reading comprehension skills will participate in the study. We will consult our advisory board members to ensure that we remain current with any changes and refinements within the definition and assessment of students with learning disabilities which might evolve during the project.

The following quantitative background information will be gathered on the sample: Computer skills, age, gender, socioeconomic status, ethnicity, and supportive services provided by the school. Informed consent will be obtained from the parents of all students selected to participate in this project evaluation, as well as from the students themselves, and the privacy of the students will be respected throughout. Table 2 below outlines the samples to be used in each year of the study.

Table 2: The samples in each year of the proposed study

	Minimum sample sizes	Selection strategies	Number of schools	Number of classrooms	Groups
YEAR 1	20	Not randomly selected	1	3	4 groups of 5 students

YEAR 2	36	Not randomly selected	2	At least 3	2 groups of 18 students (matched by gender & age)
YEAR 3	80	Randomly selected & assigned	several	several	40 students in each of the 2 experimental group (matched by gender, age, & comprehension)

Year 1:

Four small samples (n = 5) of students with learning disabilities will be drawn for in this phase of the study. The samples will not be randomly selected nor matched by gender or other characteristics as this is not necessary during a formative evaluation.

Year 2:

A randomly selected sample of at least 36 students with learning disabilities, taken from at 2 middle schools, will be drawn for this year of the study. Half of the sample will be randomly assigned to use the new instructional technique and the other half will form a control group whose instruction will be "traditional" Reciprocal Teaching (refer to Table 2). If possible, students will be selected from 1 classroom in each school to minimize teacher effects, and groups will be matched by gender and age. Otherwise, class membership will be addressed as background data.

Table 3: Experimental groups in the second year of the study

	Materials	**Focus of comprehension instruction**
Control Group	Standard written materials	Whatever teachers currently provide
Technology Enhanced Reciprocal Teaching Group	Standard written materials plus digitized and enhanced version of materials presented in CAST's eReader.	Reciprocal Teaching instruction, paired with strategic reading practice on computer.

Year 3:

A randomly selected sample of at least 80 students with learning disabilities from several middle schools will be drawn. Three groups are used in this phase of study matched by gender, age and reading comprehension levels. Table 3 below outlines these.

Table 3: Experimental groups in the third year of the study (n = at least 40 per group)

	Materials	**Focus of comprehension instruction**
Reciprocal Teaching Group (Control)	Standard written materials	Reciprocal Teaching instruction & practice
Technology Enhanced Reciprocal Teaching Group	Standard written materials plus digitized and enhanced materials presented on computer.	Reciprocal Teaching instruction, paired strategic reading practice on computer.

(3) Instrumentation

Qualitative data collection methods will include: student and classroom observations, student and teacher interviews, user feedback, copies of student work, and assessment of questioning strategies. Protocols for the student and classroom observations will be developed, in concert with teachers and project participants, and will consist of both systematic and anecdotal avenues for recording students' behaviors during instruction and practice. Protocols for the student interviews will be developed, consisting of questions about their use of the instructional technique, their use of comprehension strategies and their opinions about reading and about themselves as readers. Teacher interviews will consist of questions about their use and effectiveness of instructional technique, attitudes towards the questioning strategies, and feedback about student performance on reading comprehension tasks. Additional data on use of questioning strategies will come from student reports of what strategies they use while reading (elicited at intervals). We will observe the behavior of student pairs as they develop questions for specific passages and explain them to a peer in order to gain insight into the strategies that the student "teacher" knows and uses.

Quantitative data collection methods will include: a standardized measure of reading comprehension, experimenter-designed measures of reading comprehension, an experimenter-designed measure of questioning strategies, and two measures that assess students' attributions of academic success or failure and self-concepts as learners. The Stanford 9 Diagnostic Reading Test was selected as the standardized measure of reading comprehension because it is psychometrically robust, highly regarded, and it is administered annually to all middle school students in Boston Public Schools. The experimenter designed measures of reading comprehension and reading strategy use will be developed in concert with participating teachers and advisory board member Scott Paris during the course of the project. Types of comprehension questions will include both literal/factual and interpretive/inferential. Measures of strategy use will include forms of both direct student reports and think-alouds. Portions of the Harter Perceived Competence Scales (Harter, 1982) will be used to assess the students' attributions and self-concepts.

(4) Data Analysis Proceedures

Year I data are collected to inform the development process, and so analysis will be systematic but informal, resulting in written recommendations that will guide the development and refinement of the instructional technique. The quantitative data collected during year 2 and year 3 will be analyzed to compare results of the experimental and control groups, as well as within groups (technology enhanced Reciprocal Teaching group, "traditional" Reciprocal Teaching control group), in reading comprehension, questioning strategies and attributions/self-concept. For each year's data, univariate analyses will be performed, and three gain scores will be calculated for each student (reading comprehension, questioning strategies and attributions/self-concept) by subtracting pre-test scores from post-test scores. Then, three regression models will be fit (each using one of the gain scores as the outcome variable, experimental group as a predictor) to further examine differences between and within experimental and control groups. Independent variables representing background information gathered on students will be created and included in models both individually

and in groups to determine which, if any, are appropriate for use as control variables. Similarly, appropriate interaction variables will be created, and their predictive value evaluated. Residual analyses will be conducted to insure that no unusual individual cases have unduly influenced the analysis.

The qualitative information will be analyzed in different ways, depending upon the purpose for which it was gathered. (Miles & Huberman, 1994)

Case study data are collected to allow us to construct a detailed picture of the processes undertaken by four students as they use the intervention technique. The data for each student will be aggregated and a coding scheme will be developed to capture dimensions of interest. Using Nud•ist, a computer program designed for the task (Sage, 1996), the codes will be assigned to the data which allow simultaneous examination of all data pertaining to any dimension of interest. This will allow efficient construction of 4 narrative case studies (Miles & Huberman, 1994) that will inform discussions of the approach's efficacy, generalization to new contexts, and potentially useful future refinements.

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